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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/649,697	08/28/2003	Satoru Ohishi	242158US3S	6746

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EXAMINER	
BROOME, SAID A	

ART UNIT	PAPER NUMBER
2628	

DATE MAILED: 10/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/649,697	OHISHI, SATORU	
	Examiner	Art Unit	
	Said Broome	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/5/06 has been entered.

Response to Amendment

1. This office action is in response to an amendment filed 9/5/2006.

2. Claims 1-20 are original.

3. Claims 21 and 22 have been added by the applicant.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli et al. (herein "Negrelli", US Patent 5,712,895) in view of Strobel (US Patent 6,650,724).

Regarding claims 1 and 11, Negrelli teaches what is disclosed except for the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, and an image synthesizing unit that synthesizes the two images. Negrelli describes a storing unit that stores mask and contrast images corresponding to projection directions related to the object, which is illustrated in Figure 1 as element 42 and 70, and is described in column 2 lines 23-28, column 4 line 62 and column 5 lines 33-35. Negrelli provides a description of a memory that stores the projection directions that relate to the image taken during rotations around the object. It is also described by Negrelli that the forward images refer to the mask images, and the reverse image refer to the contrast images, in column 8 lines 5-7. Negrelli also teaches a subtracting unit that generates subtraction image data by subtracting mask images from contrast images in column 2 lines 55-60 and is illustrated in element 86 of Figure 1. Though it is not explicitly taught that mask data is generated by subtracting the subtraction data from the contrast data, it would have been obvious to one of ordinary skill in the art to perform this subtraction by substituting the subtraction image for the mask image and perform the same subtraction from the contrast data because all the data for the contrast, mask and subtraction images are all generated as taught by Negrelli(column 2 lines 55-60 and is illustrated in element 86 of Figure 1), and it would therefore have been obvious for one of ordinary skill in the art to provide any two particular sets of these data to be subtracted to generate data of interest, including mask data. Negrelli also teaches a display unit that displays the synthetic image in column 8 lines 5-7 and is illustrated as element 88 of Figure 1. Again, Negrelli fails to teach the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that

generates a 3D image of bone and/or soft tissue and one of a blood vessel, and the image synthesizing unit that synthesizes the two images. Strobel describes a reconstruction of a first set of volume data produced from mask images and a second set of volume data produced from fill images, or images with contrast agent also called contrast images, in column 1 lines 54-55. Strobel describes this reconstruction to be executed by means of a C-arm apparatus, in column 1 lines 12-16, which must contain a reconstruction unit to enable this 3D volume reconstruction. Strobel also describes generating one 3D image of a bone structure from the volume data of the mask image, and another 3D image of a blood vessel from the volume data of the contrast image in column 1 lines 12-16 and 52-55. It is known to one of ordinary skill in the art that mask images contain images of bone structure and/or tissues with the absence of a contrast agent, which is described by Strobel in column 1 lines 19-20. It is also known to one of ordinary skill in the art that contrast images contain images of blood vessels and are described by Strobel in column 1 lines 56-57. A synthetic image is generated by synthesizing the two 3D images and is described by Strobel in column 2 lines 31-40, which is illustrated in Figure 2. As previously stated, the generation of the 3D images are processed using a C-arm apparatus that comprises an image processing unit for image processing, and an image synthesizing unit for image synthesizing which is referenced by Strobel in column 1 lines 12-16 and is known in the art. Therefore it would have been obvious to one of ordinary skill in the art to combine the storing capability of several mask and contrast images, the generation of subtraction images by subtracting mask images from contrast images and combine it with a reconstruction unit that reconstructs 3D volume data of the mask and contrast images as taught by Strobel to produce two 3D images, one of which representing bone and/or tissue and the other displaying blood

vessels in Negrelli's system. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves the resolution and clarity of mask and contrast images by producing synthesized 3D images that provide a more realistic view of blood vessels for analysis.

Claims 6, 16, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli in view of Strobel in further view of Klotz et al. (herein "Klotz", US Patent 6,845,142).

Regarding claims 6 and 16, Negrelli teaches what is disclosed except for the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, an image synthesizing unit that synthesizes the two images and a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image. Negrelli describes a storing unit that stores mask and contrast images corresponding to projection directions related to the object, which is illustrated in Figure 1 as element 42 and 70, and is described in column 2 lines 23-28, column 4 line 62 and column 5 lines 33-35. Negrelli provides a description of a memory that stores the projection directions that relate to the image taken during rotations around the object. It is also described by Negrelli that the forward images refer to the mask images, and the reverse image refer to the contrast images, in column 8 lines 5-7. Negrelli also teaches a subtracting unit that generates subtraction image data by subtracting mask images from contrast images in column 2 lines 55-60 and is illustrated in element 86 of Figure 1. A display unit that displays the synthetic image is also explained by Negrelli in column 8 lines 5-7 and is illustrated

as element 88 of Figure 1. Again, Negrelli fails to teach the reconstruction unit that reconstructs the volume data of mask and subtraction images, the image processing unit that generates a 3D image of bone and/or soft tissue and one of a blood vessel, and the image synthesizing unit that synthesizes the two images. Strobel describes a reconstruction of a first set of volume data produced from mask images and a second set of volume data produced from fill images, or images with contrast agent also called contrast images, in column 1 lines 54-55. Strobel describes this reconstruction to be executed by means of a C-arm apparatus, in column 1 lines 12-16, which must contain a reconstruction unit to enable this 3D volume reconstruction. Strobel also describes generating one 3D image of a bone structure from the volume data of the mask image, and another 3D image of a blood vessel from the volume data of the contrast image in column 1 lines 12-16 and 52-55. It is known to one of ordinary skill in the art that mask images contain images of bone structure and/or tissues with the absence of a contrast agent, which is described by Strobel in column 1 lines 19-20. It is also known to one of ordinary skill in the art that contrast images contain images of blood vessels and are described by Strobel in column 1 lines 56-57. A synthetic image is generated by synthesizing the two 3D images and is described by Strobel in column 2 lines 31-40, which is illustrated in Figure 2. As previously stated, the generation of the 3D images are processed using a C-arm apparatus that comprises an image processing unit for image processing, and an image synthesizing unit for image synthesizing which is referenced by Strobel in column 1 lines 12-16 and is known in the art. Negrelli and Strobel fail to teach a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image. Klotz teaches a calibration unit configured to calibrate

the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image in column 5 lines 44-56 ("...geometrical distortions may occur if the X-ray image pick-up device includes an X-ray image intensifier which has a curved entrance screen and whose exit screen image may be influenced by the terrestrial magnetic field. In order to eliminate such distortions, in the step 103 the difference images $D_1...D_n$ are subjected to a geometrical transformation whose parameters have been determined and stored via a preceding calibration operation during which preferably a regular grid is arranged in the beam path and its reproduction in an X-ray image is evaluated."), where it is described that x-ray image data, which are acquired mask, or difference images, and contrast images as described in column 4 lines 57-61 ("After initialization (100) of the first imaging system and injection of a contrast medium, a series of n X-ray images is formed (for example, n=100) which reproduce the object to be examined and the blood vessels which are present therein and filled with contrast medium...") and in column 5 lines 1-6 ("...the images M are subtracted (step 102) from the corresponding contrast images, formed in the same angular position, so that there is formed a series of difference images $D_1,...D_i...D_n$ which reproduce only the vascular system for the various angular positions, because the other anatomic structures have been eliminated by the subtraction."), are calibrated by using a regular grid, therefore containing vertical and horizontal lines in a rectangular form, as shown in step 103 of Figure 2 where the corrected distortion results in a rectangular portion of the grid. Therefore it would have been obvious to one of ordinary skill in the art to combine the storing capability of several mask and contrast images, the generation of subtraction images by subtracting mask images from contrast images, combine it with a reconstruction unit that reconstructs 3D volume data of the mask and

contrast images as taught by Strobel to produce two 3D images, one of which representing bone and/or tissue and the other displaying blood vessels in Negrelli's system and provide a calibration unit as taught by Klotz to correct any existing image distortion. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves the resolution and clarity of mask and contrast images by producing calibrated synthesized 3D images that provide a more realistic view of blood vessels for analysis.

Regarding claims 21 and 22, Negrelli and Strobel fails to teach the limitations. Klotz teaches a calibration unit configured to calibrate the plurality of mask images and the plurality of contrast images by using vertically and horizontally arranged lines forming a lattice as a calibration image in column 5 lines 44-56 ("...geometrical distortions may occur if the X-ray image pick-up device includes an X-ray image intensifier which has a curved entrance screen and whose exit screen image may be influenced by the terrestrial magnetic field. In order to eliminate such distortions, in the step 103 the difference images $D_1...D_n$ are subjected to a geometrical transformation whose parameters have been determined and stored via a preceding calibration operation during which preferably a regular grid is arranged in the beam path and its reproduction in an X-ray image is evaluated."), where it is described that x-ray image data, which are acquired mask, or difference images, and contrast images as described in column 4 lines 57-61 ("After initialization (100) of the first imaging system and injection of a contrast medium, a series of n X-ray images is formed (for example, n=100) which reproduce the object to be examined and the blood vessels which are present therein and filled with contrast medium...") and in column 5 lines 1-6 ("...the images M are subtracted (step 102) from the corresponding contrast images, formed in the same angular position, so that there is formed a

series of difference images $D_1,...D_i...D_n$ which reproduce only the vascular system for the various angular positions, because the other anatomic structures have been eliminated by the subtraction."), are calibrated by using a regular grid, therefore containing vertical and horizontal lines in a rectangular form, as shown in step 103 of Figure 2 where the corrected distortion results in a rectangular portion of the grid. The motivation to combine the teachings of Negrelli, Strobel and Klotz is equivalent to the motivation of claim 6.

Claims 2-5 and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli in view of Strobel in further view of Vining (US Patent 5,782,762).

Negrelli in view of Strobel teaches what is disclosed in claims 2-5 and 12-15 except for the generation of color 3D images which have independent colors as recited in claims 2, 3, 12 and 13, the processing of the image using a volume rendering process as recited in claims 4 and 14 and the ability of the user to select whether the mask, contrast or synthetic image is displayed as recited in claims 5 and 15. Regarding claims 2 and 12, Vining describes generating a synthetic image in which the images are shown with different colors in column 20 lines 37-39. Regarding claims 3 and 13, it is also described by Vining that the images are given colors independent of each other in column 3 lines 42-44. Regarding claims 4 and 14, Vining describes generating the data of the images using a volume rendering process in column 13 lines 16-34, and shows that the 3D images are generated using a volume rendering technique that is known to one of ordinary skill in the art. Regarding claims 5 and 15, Vining also describes the ability of the user to select a mask, contrast or synthetic image in column 3 lines 24-31. Individual 3D images are captured as described in column 18 lines 59-60, and the user is provided with the

option to select several views of those 3D images, which would also allow the user to select one particular image of interest. Therefore it would have obvious to one of ordinary skill in the art to combine the teachings of Vining including the display of a synthetic image which contains independent colors for each 3D image that comprises it, the generation of image data using volume rendering and the enablement of the display of certain 3D images by the user in the combined system disclosed by Negrelli and Strobel. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves resolution and clarity of calibrated mask and contrast images by producing synthesized 3D images in color that provide a more realistic observation of blood vessels for analysis.

Claims 7-10 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Negrelli in view of Strobel in further view of Klotz, and in further view of Vining.

Negrelli, Strobel and Klotz teach what is disclosed in claims 7-10 and 17-20 except for the generation of color 3D images which have independent colors as recited in claims 7, 8, 17 and 18, the processing of the image using a volume rendering process as recited in claims 9 and 19 and the ability of the user to select whether the mask, contrast or synthetic image is displayed as recited in claims 10 and 20. Regarding claims 7 and 17, Vining describes generating a synthetic image in which the images are shown with different colors in column 20 lines 37-39. Regarding claim 8 and 18, it is also described by Vining that the images are given colors independent of each other in column 3 lines 42-44. Regarding claim 9 and 19, Vining describes generating the data of the images using a volume rendering process in column 13 lines 16-34, and shows that the 3D images are generated using a volume rendering technique that is known to

one of ordinary skill in the art. Regarding claims 10 and 20, Vining also describes the ability of the user to select a mask, contrast or synthetic image in column 3 lines 24-31. Individual 3D images are captured as described in column 18 lines 59-60, and the user is provided with the option to select several views of those 3D images, which would also allow the user to select one particular image of interest. Therefore it would have obvious to one of ordinary skill in the art to combine the teachings of Vining including the display of a synthetic image which contains independent colors for each 3D image that comprises it, the generation of image data using volume rendering and the enablement of the display of certain 3D images by the user in the combined system disclosed by Negrelli, Strobel and Klotz. Motivation for this combination would produce a 3D digital subtraction image processing apparatus that improves resolution and clarity of calibrated mask and contrast images by producing synthesized 3D images in color that provide a more realistic observation of blood vessels for analysis.

Response to Arguments

Applicant's arguments with respect to claims 1-22 have been considered but are moot in view of the new ground(s) of rejection.

The applicant argues that the references Negrelli and Strobel used in the 35 U.S.C. 103(a) rejection of claim 1 do not teach a first subtracting unit configured to generate data of a plurality of subtraction images by subtracting the plurality of mask images from the plurality of contrast images. The examiner maintains the rejection because Negrelli teaches a subtracting unit that generates subtraction image data by subtracting mask images from contrast images in column 2 lines 55-60 and is illustrated in element 86 of Figure 1. Though it is not explicitly taught that

mask data is generated by subtracting the subtraction data from the contrast data, it would have been obvious to one of ordinary skill in the art to perform this subtraction by substituting the subtraction image for the mask image and perform the same subtraction from the contrast data because all the data for the contrast, mask and subtraction images are all generated for analysis and subtraction as taught by Negrelli(column 2 lines 55-60 and is illustrated in element 86 of Figure 1), and it would therefore have been obvious for one of ordinary skill in the art to provide any two particular sets of these data to be subtracted to generate data of interest, including mask data.

The applicant also argues that the references Negrelli and Strobel used in the 35 U.S.C. 103(a) rejection of claim 1 do not teach a reconstruction unit configured to reconstruct first volume data form the plurality of contrast images and configured to reconstruct second volume data from the plurality of subtraction images. The examiner maintains the rejection because Strobel teaches a reconstruction of a first set of volume data produced from mask images and a second set of volume data produced from fill images, or images with contrast agent also called contrast images, in column 1 lines 54-55. Strobel describes this reconstruction to be executed by means of a C-arm apparatus, in column 1 lines 12-16, which must contain a reconstruction unit to enable this 3D volume reconstruction, where the first volume data is constructed with mask images and the second volume data is constructed with the contrast or fill images, as described in column 1 lines 46- ("...by producing a 3D angio-volume dataset V_1 based on 2D mask images, and a 3D angio-volume dataset V_2 based on 2D fill images, and the vessel tree is isolated in the fill volume dataset V_2 by means of a segmentation and is added to the mask image volume dataset V_1...").

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Said Broome whose telephone number is (571)272-2931. The examiner can normally be reached on 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571)272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

S. Broome SB
10/10/06

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